Chapter 3

Statewide Trends and Forecasts -- Criteria Pollutants

Introduction
Emission Trends and Forecasts

Any data prior to this year are derived from historical emissions data where available, and backcasted emissions based on historical socio-economic growth and control information. The most current emissions data available are from 2005. Any data prior to this year are derived from historical emissions data. Future year data are forecasted from the 2005 base year and control measures reported through September 2005. Forecasts take into account emissions data, projected growth rates, and future adopted control measures to calculate emissions in future years.

On a statewide basis, emissions of NO_x increased between 1975 and 1980, but are forecasted to decline between 1980 and 2020. Emissions of ROG decreased steadily between 1975 and 2020. In addition to being ozone precursors, both NO_x and ROG are secondary contributors to PM_{10} and $PM_{2.5}$. Direct PM_{10} emissions show an increase from 1975 to 1990, a slight decrease in 1995, hold relatively constant from 1995 to 2005, and then a slow increase after 2005. Direct $PM_{2.5}$ emissions decreased from 1975 to 1985, increased from 1985 to 1990, decreased slightly between 1990 and 1995, held relatively constant from 1995 to 2005, and are predicted to increase from 2005 to 2020.

Emissions of CO have decreased since 1985 and are forecasted to continue declining. The recent decreases in NO_x, ROG, and CO are occurring even with increases in vehicle miles traveled (VMT) and population.

Statewide SO_x emissions decreased sharply from 1975 through 1985, decreased steadily through 1995, and remained relatively constant through 2005. On-shore SO_x emissions are projected to increase moderately through 2020. Off-shore emissions are projected to increase substantially through 2020 due to increased shipping activity. In 2005, off-shore emissions represent approximately 40 percent of the statewide SO_x emission inventory. By 2020, off-shore emissions are forecasted to comprise 52 percent of the statewide SO_x emissions.

Statewide Emissions (tons/day, annual average)										
Pollutant	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020
NO_X	4949	5060	5011	4997	4319	3844	3220	2741	2359	2199
ROG	7026	6602	6068	4737	3761	3128	2430	2167	2046	2004
PM_{10}	1992	2026	2131	2316	2200	2267	2212	2254	2326	2410
PM_{25}	896	874	884	934	862	877	864	879	903	933
CO	41866	38189	36145	30221	22832	17515	13766	11408	9782	8826
SO_x	1319	103	573	520	312	304	301	336	390	463

Table 3-1

Statewide Population and VMT

Airborne pollutants result in large part from human activities, and growth generally has a negative impact on air quality. California is fortunate in that it boasts the world's most progressive emission controls. These controls have resulted in significant air quality improvements, despite substantial growth.

During 1985 through 2004, statewide maximum 1-hour ozone values decreased 59 percent, and maximum 8-hour carbon monoxide values dropped 63 percent. These air quality improvements occurred at the same time the State's population increased 39 percent and the average daily VMT increased 90 percent. Ambient annual average PM_{10} values in the non-desert areas also show improvement: a 43 percent decrease from 1989 to 2004. While the air quality improvements are impressive, additional emission controls will be needed to offset future growth.

Percent Change in Air Quality and Growth

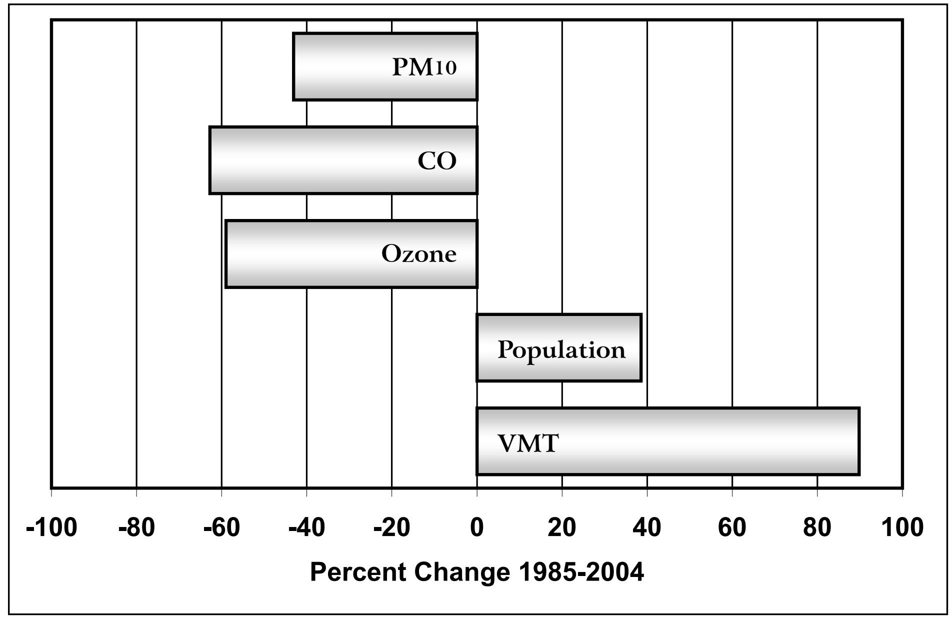

Figure 3-1

Statewide Population and VMT Trends									
Parameter	1980	1985	1990	1995	2000	2005	2010	2015	2020
Population (1000s)	23782	26402	29829	31711	34036	37473	40262	42711	45822
Avg. Daily VMT(1000s)	389107	517683	677171	731207	796075	872885	957360	1032915	1109515

Table 3-2

Ozone

Emission Trends and Forecasts - Ozone Precursors

NO_x Emission Trends and Forecasts

NO_x emission standards for on-road motor vehicles were introduced in 1971 and followed in later years by the implementation of more stringent standards and the introduction of three-way catalysts. NO_x emissions from on-road motor vehicles have declined by 28 percent from 1990 to 2000, and NO_x emissions are projected to decrease by an additional 52 percent between 2000 and 2020. This has occurred as vehicles meeting more stringent emission standards enter the fleet, and all vehicles use cleaner burning gasoline and diesel fuel or alternative fuels.

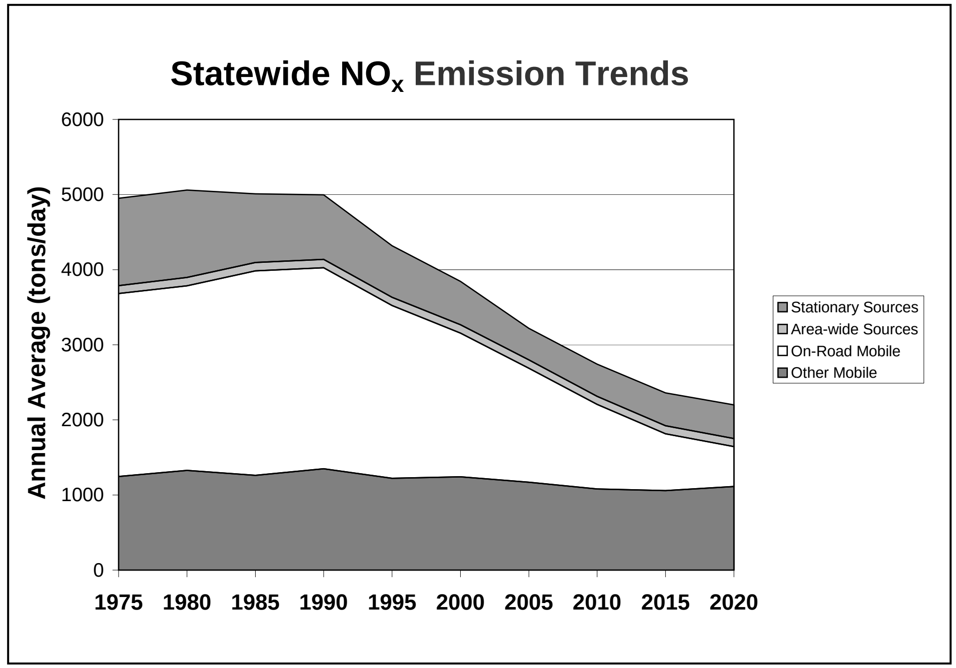

Figure 3-2

NOx emissions from other mobile categories on the whole decreased from 1990 to 2020. The two largest NOx contributors in the other mobile category are off-road combustion equipment and ships. The emissions from off-road combustion equipment decrease significantly over the entire forecast period. However, the emissions for ships have increased to better reflect actual shipping activity resulting in a fairly constant NO_x emission level for the trend and forecast period for the Other Mobile category as a whole. Stationary source NO_x emissions dropped by 64 percent between 1980 and 2005. This decrease has been largely due to a switch from fuel oil to natural gas and the implementation of combustion controls such as low-NO_x burners for boilers and catalytic converters for both external and internal combustion stationary sources. State Implementation Plan (SIP) and conformity inventory forecasts may differ from the forecasts presented in this almanac. For additional information on these forecasts, please refer to the ARB SIP web page at *www.arb.ca.gov/planning/sip/sip.htm*.

ROG Emission Trends and Forecasts

ROG emissions in California are projected to decrease by over 72 percent between 1975 and 2020, largely as a result of the State's on-road motor vehicle emission control program. This includes the use of improved evaporative emission control systems, computerized fuel injection, engine management systems to meet increasingly stringent California emission standards, cleaner gasoline, and the Smog Check program. ROG emissions from other mobile sources are projected to decline between 1990 and 2020 as more stringent emission standards are adopted and implemented. Substantial reductions have also been obtained for area-wide sources through the vapor recovery program for service stations, bulk plants, and other fuel distribution operations. There are also on-going programs to reduce overall solvent ROG emissions from coatings, consumer products, cleaning and degreasing solvents, and other substances used within California. Again, State Implementation Plan (SIP) and conformity inventory forecasts may differ from the forecasts presented in this almanac. For additional information on these forecasts, please refer to the ARB SIP web page at *www.arb.ca.gov/planning/sip/sip.htm*.

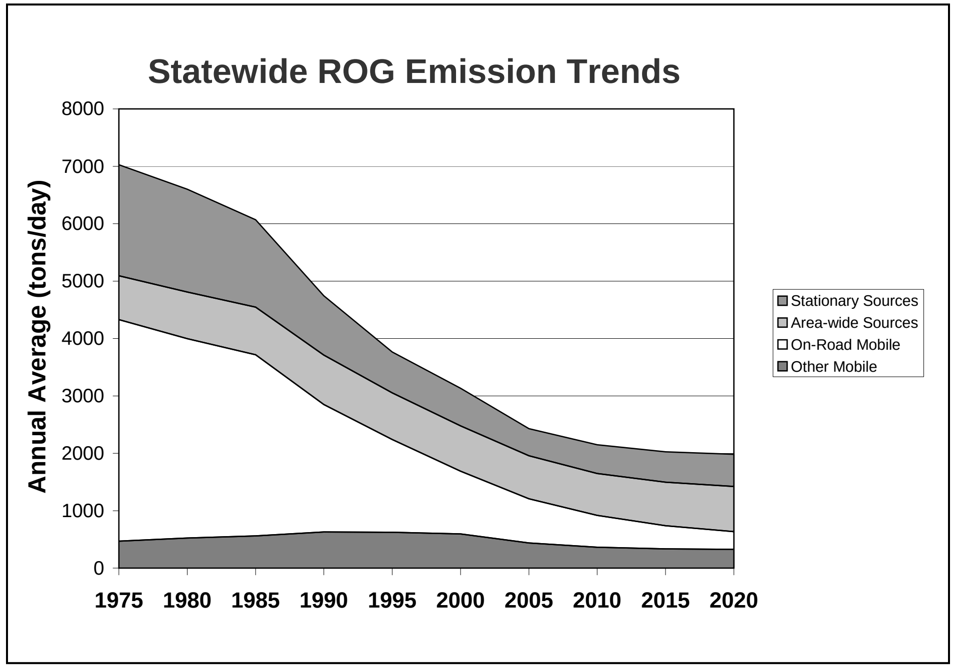

Figure 3-3

Emission Trends and Forecasts - Ozone Precursors

NO_x Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***4949***	***5060***	***5011***	***4997***	***4319***	***3844***	***3220***	***2741***	***2359***	***2199***
Stationary Sources	1162	1164	915	861	686	577	420	427	437	447
Area-wide Sources	106	111	113	112	110	110	112	108	107	108
On-Road Mobile	2435	2459	2721	2675	2301	1915	1518	1127	757	532
Gasoline Vehicles	2149	1975	1936	1789	1535	1113	757	536	371	266
Diesel Vehicles	286	484	784	885	766	802	761	590	386	266
Other Mobile	1247	1326	1262	1350	1222	1241	1169	1080	1057	1112
Gasoline Fuel	42	47	52	61	60	67	74	67	62	60
Diesel Fuel	980	1066	1003	1052	901	877	754	617	524	474
Other Fuel	224	213	207	237	261	298	341	395	472	578

Table 3-3

ROG Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***7026***	***6602***	***6068***	***4737***	***3761***	***3128***	***2430***	***2167***	***2046***	***2004***
Stationary Sources	1933	1792	1520	1031	713	654	473	499	530	561
Area-wide Sources	763	813	830	855	807	784	750	749	777	807
On-Road Mobile	3861	3474	3156	2221	1618	1094	770	554	404	311
Gasoline Vehicles	3845	3445	3110	2178	1583	1063	740	529	383	294
Diesel Vehicles	16	29	46	43	35	30	30	25	20	17
Other Mobile	469	523	561	630	623	596	437	364	335	325
Gasoline Fuel	330	374	425	482	493	470	318	257	234	225
Diesel Fuel	88	96	90	94	84	79	71	57	45	38
Other Fuel	50	52	47	53	46	46	48	51	55	61

Table 3-4

Statewide Air Quality - Ozone

Air quality as it relates to ozone has improved greatly in all areas of California over the last 20 years, despite significant growth. The statewide trend, which reflects values for the South Coast Air Basin, shows that the maximum peak 8-hour and 1-hour indicators declined by almost half from 1985 to 2004. During 1985 to 2004, the statewide population grew by 39 percent and the number of vehicle miles traveled each day was up more than 90 percent. Motor vehicles are the largest source category of ozone precursor emissions, and reducing their emissions will continue to be the cornerstone of California's ozone control efforts. New vehicles must meet the ARB's low emission vehicle standards, which equate to about 95 percent fewer smog-forming emissions than vehicles produced in the 1970s. However, increases in population and driving are partially offsetting the benefits of cleaner vehicles. In addition to motor vehicle controls, the ARB is establishing controls for other sources of ozone precursor emissions, such as consumer products. The ARB and other agencies are also looking at new and more efficient ways of doing business and implementing incentive programs to improve air quality.

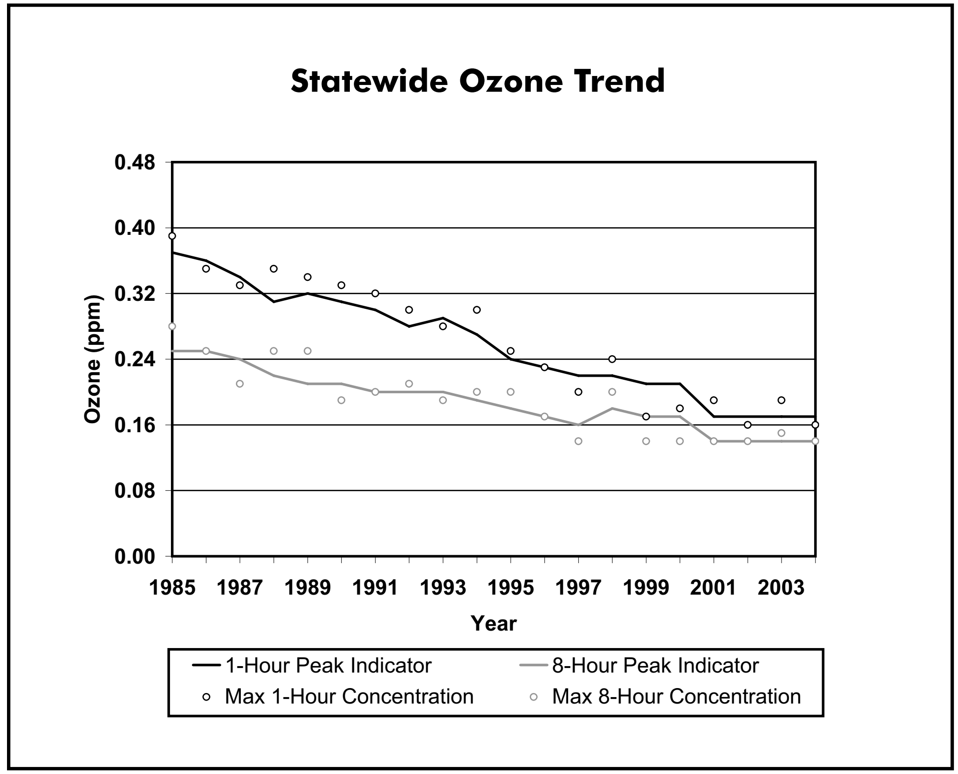

Figure 3-4

Population-Weighted Exposures Over the State Ozone Standard

There are a number of ways to look at how ozone levels have changed over the years. Though simple indicators are most commonly used, complex indicators can offer additional insight concerning air quality. One such indicator is the *population-weighted exposure* indicator. As used here, an “exposure” occurs when a person experiences a one-hour ozone concentration outdoors that is higher than 0.09 ppm, the level of the State standard. The population-weighted exposure indicator considers both the level and the duration of ozone concentrations above the State standard. The annual exposure is the sum of all the hourly exposures during the year and presents the result as an average per exposed person.

In contrast to the peak indicator, which provides an indication of the potential for acute adverse health impacts, the population-weighted exposure provides an indication of the potential for chronic adverse health impacts. For the purposes of computing the exposures in this almanac, individuals are presumed to have been exposed to concentrations measured by the ambient (outdoor) air quality monitoring network. However, daily activity patterns (for example, being inside a building or exercising outdoors) may diminish or increase exposures to some outdoor concentrations that exceed the State standard. While many indicators characterize air quality at an individual monitoring location, the exposure indicator provides an integrated regional perspective. For each hour, the calculations simultaneously consider ozone data from all of the monitors in a region. People living in areas where ozone exceeds the standard are then included in the population-weighted exposure for that hour.

The examples below show two simple exposure calculations. First, a measured ozone concentration of 0.11 ppm for one hour represents an exposure of 0.02 ppm-hours above the State ozone standard of 0.09 ppm:

$$(0.11 \text{ ppm} - 0.09 \text{ ppm}) \times 1 \text{ hour} = 0.02 \text{ ppm-hours}$$

Second, a measured concentration of 0.10 ppm for two hours also equals an exposure of 0.02 ppm-hours:

$$(0.10 \text{ ppm} - 0.09 \text{ ppm}) \times 2 \text{ hours} = 0.02 \text{ ppm-hours}$$

In contrast to these examples, when the concentration is equal to or below the level of the State standard of 0.09 ppm, the exposure is zero. The population associated with these “zero” exposures are not included in the exposure calculations in this almanac because including population with the zero exposures dilutes the real impact of the ozone concentrations that are above the State standard and are, therefore, adversely affecting public health. In all cases, an exposure calculation that excludes the zero values will be higher than one incorporating concentrations at or below the level of the standard (areas of zero exposure).

The population-weighted exposures in Table 3-5 are listed for each year, from 1984 through 2004, for the five most populated areas of California: the South Coast Air Basin, the San Francisco Bay Area Air Basin, the San Joaquin Valley Air Basin, the San Diego Air Basin, and the Sacramento Metropolitan Area (the southern, urbanized portion of the Sacramento Valley Air Basin and a portion of the Mountain Counties Air Basin). While these areas do not encompass all of California’s ozone nonattainment areas, they do include the major urban areas where the majority of the State’s population lives.

The exposure values listed in Table 3-5 are presented in parts per million to be consistent with the units in which the State standard is expressed. In addition to the exposure values, Table 3-5 also lists the percent of the total population represented in the exposure value. The percent value reflects the percent of the total population in the area that was exposed to an ozone concentration above the level of the State 1-hour standard for at least one hour during the year. Because the exposure result is an average, it may not accurately portray the exposure of any particular individual or subarea. Some people in the region experience higher exposure while others experience lower exposure. Nevertheless, this method provides a reasonable approach for comparing exposures among various regions and for assessing trends in exposure reductions.

The calculations for the exposure indicators are based on all concentrations measured in the area that satisfy the specified data requirements. The population is based on census tract data, and the calculation is performed at the census tract level and then aggregated to the regional level. Exposures for the years 1984 through 1999 use census information for 1990, while exposures for the years 2000 through 2004 use census information for the year 2000. General details about the computational procedure can be found in the ARB publication entitled: *"Guidance for Using Air Quality-Related Indicators in Reporting Progress in Attaining the State Ambient Air Quality Standards"* (September 1993).

Ozone Exposures Over the State Standard: Population-Weighted (ppm-hours / person)																					
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
South Coast Air Basin																					
Exposure	36.58	36.90	35.68	31.41	34.28	29.58	22.10	22.21	21.99	17.96	18.90	13.26	10.67	6.28	8.90	3.28	5.33	6.95	7.16	8.92	5.21
% Pop. Represented*	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	100%	92%	98%	99%	100%	88%	78%	91%	83%
San Francisco Bay Area Air Basin																					
Exposure	2.28	1.45	0.85	1.81	1.24	0.67	0.46	0.48	0.54	0.41	0.26	1.06	1.03	0.10	0.95	0.62	0.33	0.35	0.35	0.32	0.11
% Pop. Represented	100%	73%	46%	72%	73%	53%	41%	45%	50%	72%	39%	81%	60%	48%	54%	65%	25%	48%	28%	62%	30%
San Joaquin Valley Air Basin																					
Exposure	7.25	8.09	10.00	10.09	9.38	7.12	5.21	6.09	5.64	6.18	6.43	6.10	6.96	3.73	6.63	4.51	4.63	4.75	5.84	5.24	3.28
% Pop. Represented	97%	97%	95%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	97%
San Diego Air Basin																					
Exposure	6.94	8.17	5.16	5.64	7.40	7.29	6.35	3.92	3.31	2.74	2.28	2.41	1.19	0.83	1.93	0.60	0.52	0.71	0.38	0.45	0.24
% Pop. Represented	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	79%	100%	98%	100%	82%	69%	72%	89%	62%	36%	71%
Broader Sacramento Metropolitan Area																					
Exposure	3.11	2.88	2.57	3.19	4.22	1.83	2.14	2.47	2.35	1.10	1.76	2.20	1.85	0.51	1.98	1.45	1.15	1.08	1.52	1.15	0.43
% Pop. Represented	100%	93%	94%	100%	100%	100%	100%	99%	100%	100%	95%	100%	100%	98%	100%	100%	99%	100%	99%	97%	94%

* *% Population Represented* is the percent of the total population residing in an area exposed to an ozone concentration above the level of the State standard for at least one hour during the year.

Table 3-5

Ozone Transport

Since 1989, the ARB staff has evaluated the impacts of the transport of ozone and ozone precursor emissions from upwind areas to the ozone concentrations in downwind areas. These analyses demonstrate that the air basin boundaries are not true boundaries of air masses. All urban areas are upwind contributors to their downwind neighbors with the exception of San Diego. Figure 3-5 shows the upwind areas that impact downwind areas throughout the State. The ozone problem in some rural areas is caused almost solely by transported pollutants. These areas, although designated as nonattainment, are not required to adopt an air quality plan because local control strategies in these areas would not be effective in reducing ozone concentrations. However, these areas are subject to many statewide control strategies, such as cleaner fuels and low emission vehicles. More detailed information about ozone transport is available on the web at *www.arb.ca.gov/aqd/transport/transport.htm*.

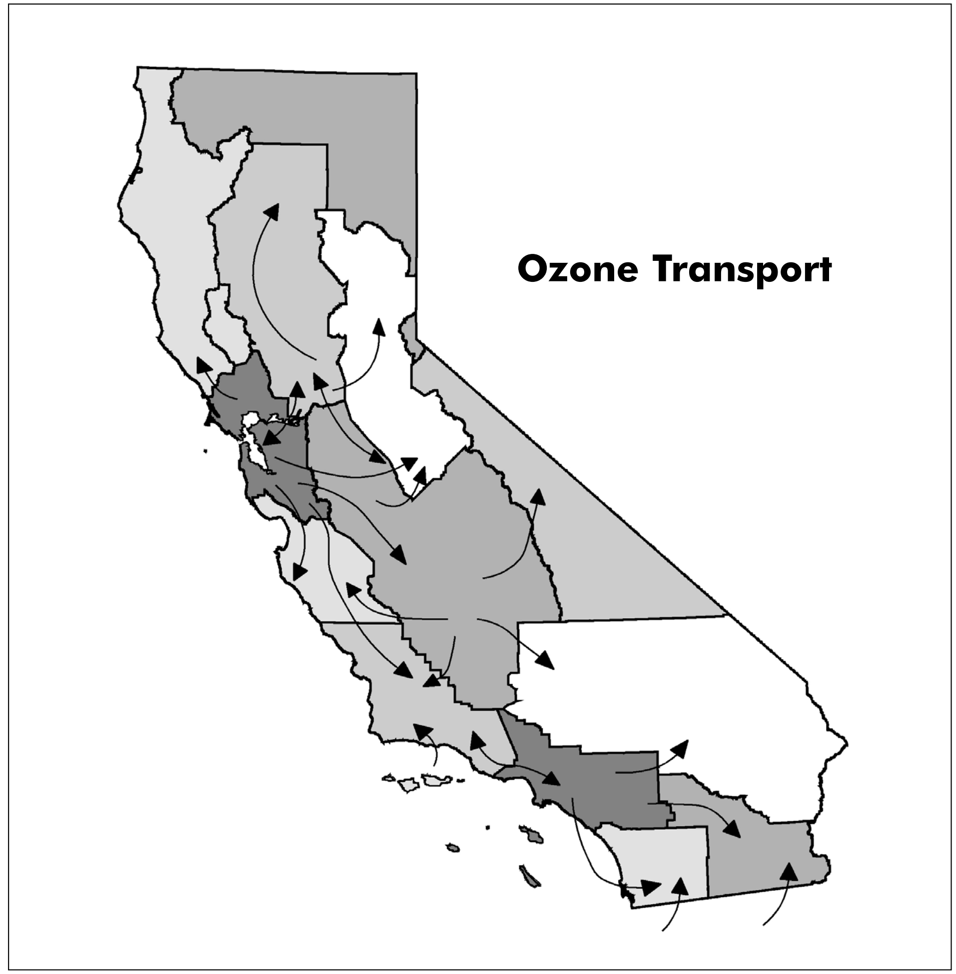

Figure 3-5

Directly Emitted Particulate Matter (PM_{10})

Emission Trends and Forecasts - Directly Emitted PM_{10}

PM_{10} emissions increase from 1975 to 1990, then decrease slightly in 1995, increase in 2000, decrease in 2005, and are projected to slowly increase after 2005. PM_{10} emissions are dominated by area-wide sources. Emissions from paved road dust more than double between 1975 and 2000. Unpaved road dust emissions generally increase through the forecast period. Other area-wide sources include farming operations, construction and demolition, and fugitive wind blown dust from agricultural lands. Emissions from these categories have compensating effects resulting in a fairly constant statewide emission level; emissions increase slightly over the forecast period. The increase in emissions of unpaved and paved road dust are due to increases in VMT over these roads. Exhaust emissions from diesel mobile sources dropped by 36 percent from 1990 to 2000 due to more stringent emissions standards and the introduction of cleaner burning diesel fuel. PM_{10} emissions from stationary sources are expected to increase slightly in the future due to industrial growth.

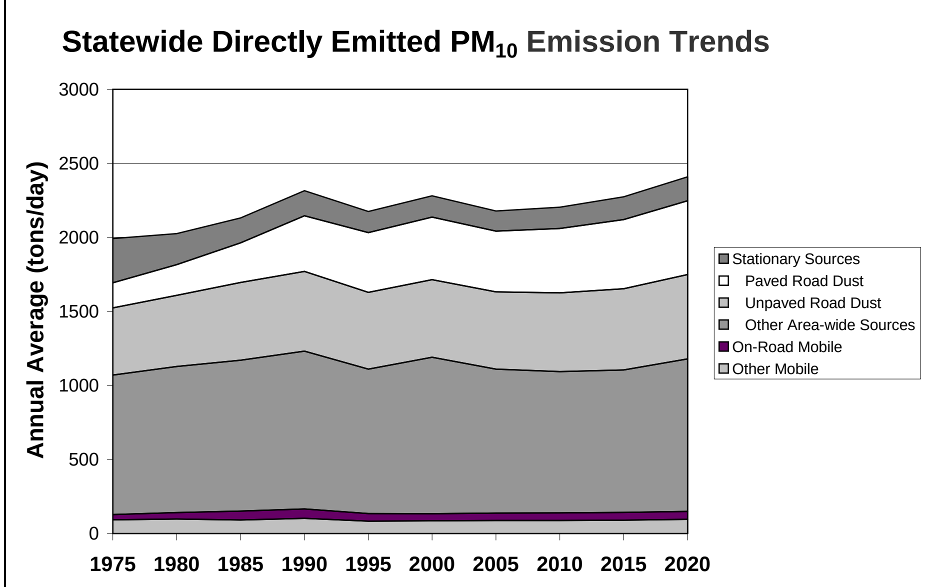

Figure 3-6

Directly Emitted PM_{10} Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***1992***	***2026***	***2131***	***2316***	***2200***	***2267***	***2212***	***2254***	***2326***	***2410***
Stationary Sources	300	210	168	170	142	144	136	144	153	162
Area-wide Sources	1565	1675	1811	1980	1923	1988	1938	1971	2031	2098
Paved Road Dust	168	208	267	376	404	422	411	435	467	498
Unpaved Road Dust	454	480	525	538	518	525	521	531	549	570
Other Area-wide Sources	942	987	1020	1067	976	1056	972	955	963	1030
On-Road Mobile	36	43	60	63	51	49	50	51	52	54
Gasoline Vehicles	22	19	21	25	27	30	34	39	43	47
Diesel Vehicles	14	24	38	38	24	18	16	12	9	8
Other Mobile	93	98	92	103	84	86	88	88	90	96
Gasoline Fuel	6	7	8	10	11	13	15	17	18	19
Diesel Fuel	63	68	61	66	50	48	44	37	31	26
Other Fuel	24	23	23	27	23	25	29	34	40	50

Table 3-6

Directly Emitted Particulate Matter ($PM_{2.5}$)

Emission Trends and Forecasts - Directly Emitted $PM_{2.5}$

$PM_{2.5}$ emissions decrease from 1975 to 1980 as a result of reduced stationary source emissions. Emissions increase slightly between 1980 and 1990, hold steady through 2005, and are projected to increase after 2005. $PM_{2.5}$ emissions are dominated by area-wide sources. Emissions from paved road dust more than double between 1975 and 2000. Unpaved road dust emissions increase through the year 1990, decrease in 1995, hold relatively constant through the year 2010, with increased emissions expected after 2010. Other area-wide source emissions increase slightly over the forecast period. The increase in emissions of unpaved and paved road dust are due to increases in VMT over these roads. Exhaust emissions from diesel mobile sources dropped by 36 percent from 1990 to 2000 due to more stringent emissions standards and the introduction of cleaner burning diesel fuel. $PM_{2.5}$ emissions from stationary sources are expected to increase slightly in the future due to industrial growth.

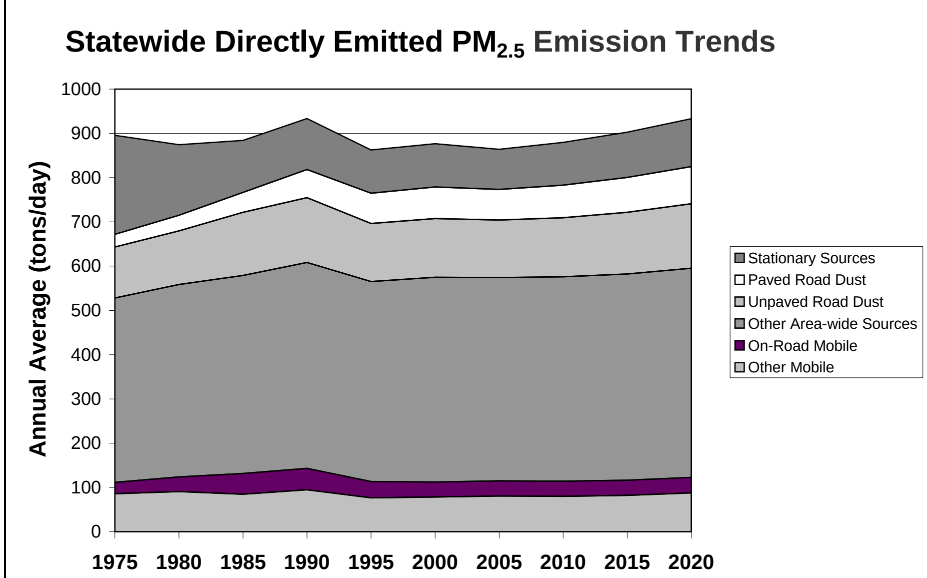

Figure 3-7

Directly Emitted $PM_{2.5}$ Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***896***	***874***	***884***	***934***	***862***	***877***	***864***	***879***	***903***	***933***
Stationary Sources	224	160	117	115	98	98	91	97	102	108
Area-wide Sources	560	591	635	675	651	667	659	669	684	702
Paved Road Dust	28	35	45	63	68	71	69	73	79	84
Unpaved Road Dust	115	121	143	147	131	133	130	134	139	146
Other Area-wide Sources	416	435	447	465	452	463	459	462	466	473
On-Road Mobile	26	33	47	48	37	34	34	34	34	35
Gasoline Vehicles	13	11	12	13	15	17	20	23	26	28
Diesel Vehicles	12	22	35	35	22	17	15	11	9	7
Other Mobile	86	91	85	95	77	78	80	80	82	88
Gasoline Fuel	4	5	6	7	8	10	12	13	14	15
Diesel Fuel	58	63	56	61	46	44	40	34	29	24
Other Fuel	23	23	22	26	23	25	28	33	40	49

Table 3-7

Statewide Air Quality - PM_{10}

In contrast to ozone and carbon monoxide, PM_{10} concentrations do not relate as well to growth in population or vehicle usage, and high PM_{10} concentrations do not always occur in high population areas. Activities that contribute directly to high PM_{10} include wood burning, agricultural activities, and driving on unpaved roads. In addition, emissions from stationary sources and motor vehicles form secondary particles that contribute to PM_{10} in many areas. Figure 3-8 shows the statewide annual average for PM_{10} concentrations for a non-desert area. The trend line reflects, for the most part, the South Coast Air Basin. The low value for the annual average in 1988 is due to the limited number of monitors with complete data for this year during the startup of the PM_{10} monitoring network. The period between 1989 and 2004 provides a better indication of trends. Over this period, the three-year average of the annual average shows a decrease of more than 32 percent. However, there is a great deal of variability, especially during the late 1990's. Much of this variability may be due to meteorology rather than changes in emissions. Currently, over 99 percent of Californians live in air basins with concentrations that violate the State PM_{10} standards during at least part of the year. As a result, PM is commanding greater attention.

In 2003, the Legislature enacted Senate Bill 656 (SB656) to reduce public exposure to PM_{10} and $PM_{2.5}$. As a first step in the implementation of SB656, in November 2004, the ARB approved an extensive list of the most readily available, feasible, cost-effective control measures that can be employed by air districts to reduce PM_{10} and $PM_{2.5}$. The goal is to make progress towards attaining the State and national PM_{10} and $PM_{2.5}$ standards.

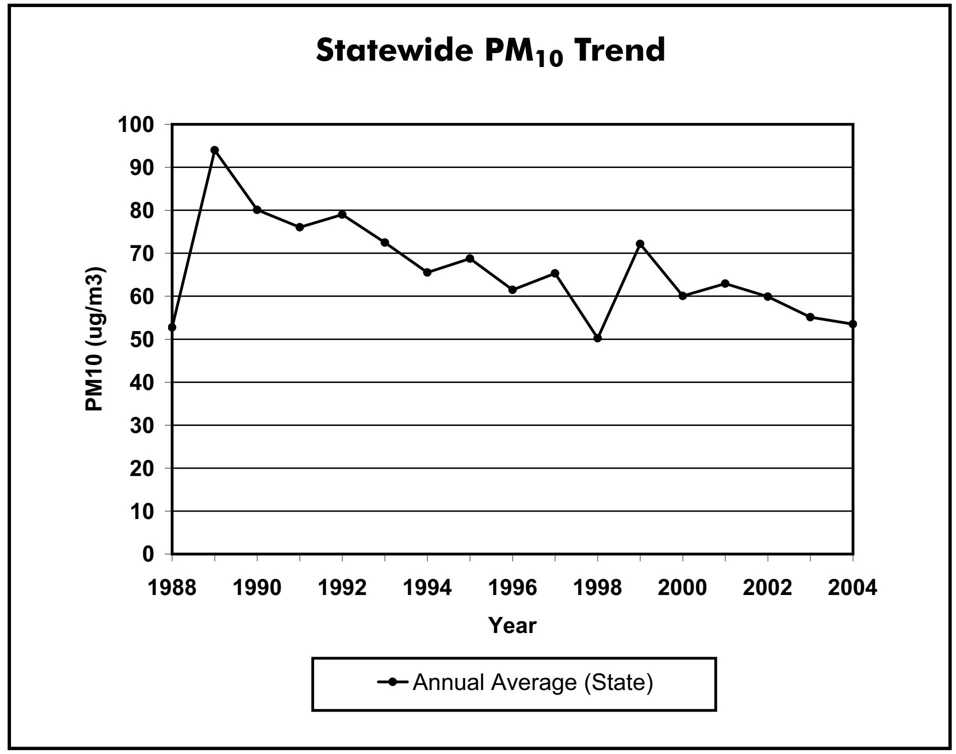

Figure 3-8

Statewide Air Quality - $PM_{2.5}$

Comprehensive monitoring for $PM_{2.5}$ began in 1999, therefore only limited data are available to evaluate statewide trends. Currently, most urban areas in the State, as well as several isolated sub-areas violate the State $PM_{2.5}$ annual average standard. Activities that contribute to high $PM_{2.5}$ concentrations include direct particulate emissions from mobile sources and burning, as well as the formation of $PM_{2.5}$ from the reactions of precursor gases. Because attainment plans due in 2008 for the national $PM_{2.5}$ standards are the focus of current planning efforts. Figure 3-9 shows the maximum statewide annual average $PM_{2.5}$ concentrations from 1999 through 2004 from the national perspective. The national annual average is also used in the air basin summaries in Chapter 4. Over the six year period, the annual average shows a decrease of approximately 29 percent. Similar to PM_{10}, year-to-year changes in meteorology can mask the impacts of emission control programs. Several more years are needed before determining longer-term trends. As with PM_{10}, $PM_{2.5}$ represents one of the most formidable health challenges in California. The measures adopted as part of SB656 to reduce PM_{10} and $PM_{2.5}$ (program description can be found on the ARB website at *www.arb.ca.gov/pm/pmmeasures/pmmeasures.htm*), as well as programs to reduce ozone and diesel PM will help in reducing public exposure to $PM_{2.5}$.

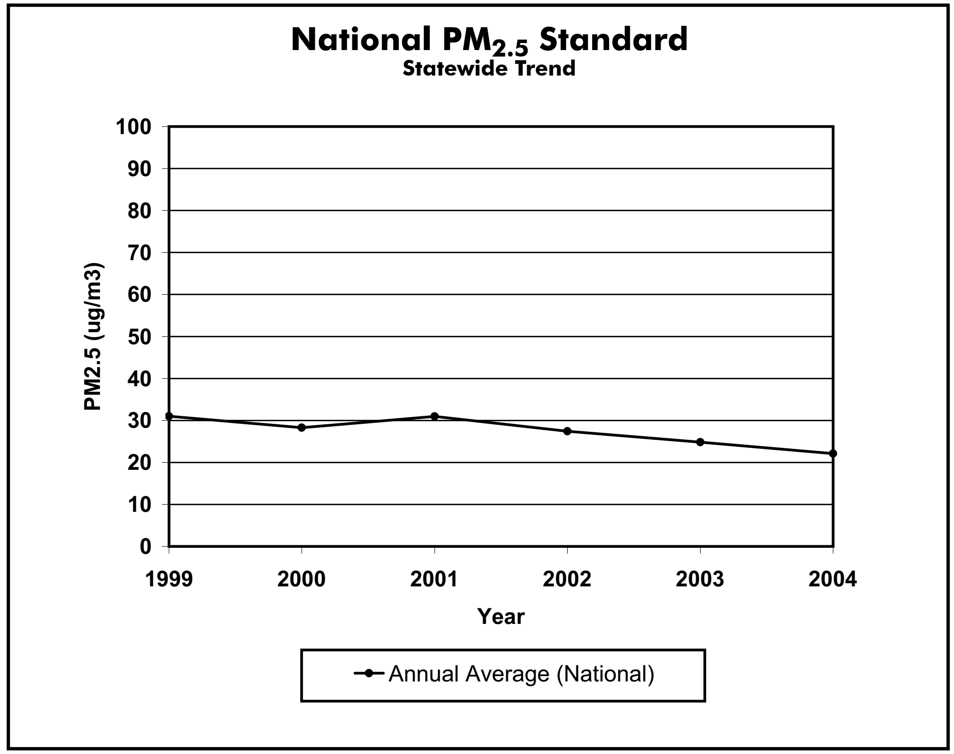

Figure 3-9

Carbon Monoxide (CO)

Emission Trends and Forecasts - Carbon Monoxide

Since 1975, even though VMT have continued to climb, the adoption of more stringent motor vehicle emissions standards has dropped statewide CO emissions from on-road motor vehicles by over 78 percent in 2005. With continued vehicle fleet turnover to cleaner vehicles, including super ultra low emitting vehicles (SULEVs) and zero emission vehicles (ZEVs), and the incorporation of cleaner burning fuels, CO emissions are forecast to continue decreasing through the year 2020. CO emissions from other mobile sources are also projected to decrease through 2010 as more stringent emissions standards are implemented with moderate increases expected after 2010. CO emissions from area-wide sources are expected to increase slightly due to increased waste burning and additional residential fuel combustion resulting from population increases.

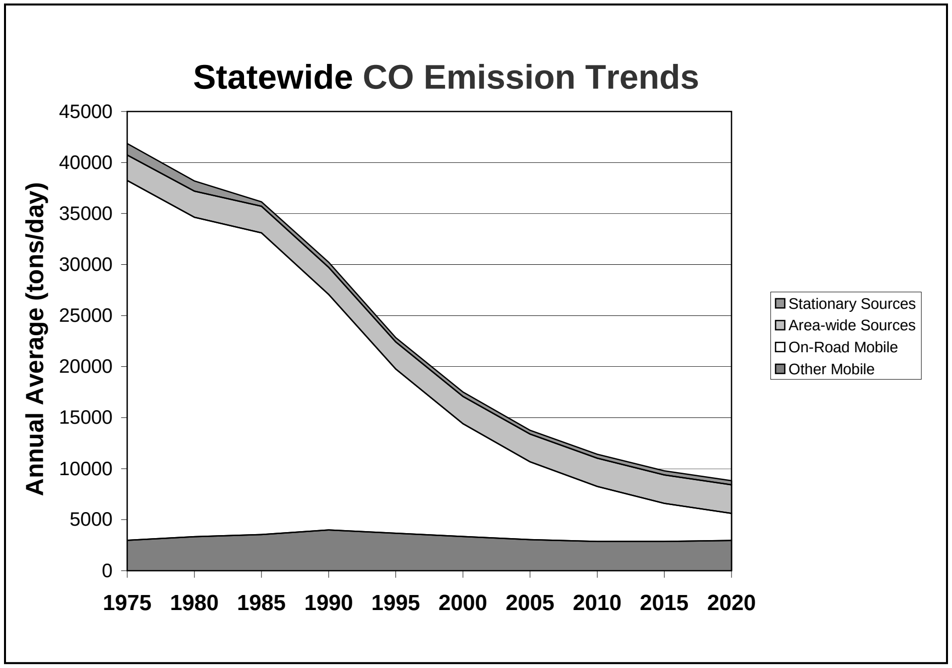

Figure 3-10

CO Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***41866***	***38189***	***36145***	***30221***	***22832***	***17515***	***13766***	***11408***	***9782***	***8826***
Stationary Sources	1125	998	440	491	420	433	372	390	402	417
Area-wide Sources	2500	2560	2604	2658	2652	2675	2719	2759	2773	2791
On-Road Mobile	35269	31295	29565	23087	16090	11059	7629	5397	3744	2661
Gasoline Vehicles	35199	31171	29359	22878	15915	10909	7487	5272	3636	2561
Diesel Vehicles	69	124	205	209	174	150	143	125	108	101
Other Mobile	2972	3336	3537	3986	3671	3347	3045	2862	2863	2957
Gasoline Fuel	2228	2521	2791	3180	2956	2680	2392	2200	2183	2251
Diesel Fuel	366	415	401	430	361	314	275	256	247	245
Other Fuel	378	400	345	375	353	353	378	405	432	461

Table 3-8

Statewide Air Quality - Carbon Monoxide

Similar to ozone, carbon monoxide concentrations in all areas of California have decreased substantially over the last 20 years, despite significant growth. Statewide, the maximum peak 8-hour indicator declined about 50 percent from 1985 to 2004.

During 2003, measured CO concentrations exceeded the State and national standards only in San Diego County. San Diego experienced unusually high CO values during late October, including levels that exceeded the CO standards on October 28, 2003. These high values were due to extensive wildfires that impacted air quality throughout southern California. These types of exceptional events do not affect the area's attainment status.

In 2004, CO levels returned to normal throughout the state. San Diego County CO levels dropped to less than half of what they were in 2003. Of the five major air basins covered in the Almanac, none exceeded the State or national 8-hour standards.

The introduction of cleaner fuels has helped bring the entire State into attainment with the exception of the City of Calexico (Note: Although the South Coast Air Basin is designated as nonattainment for the national CO standards, CO concentrations in this area no longer violate the national standards.). While cleaner fuels will have a continuing impact on carbon monoxide levels, additional emission reductions will be needed in the future to keep pace with increases in population and vehicle usage. These reductions will come from continued fleet turnover, expanded use of low emission vehicles, and measures to promote less polluting modes of transportation.

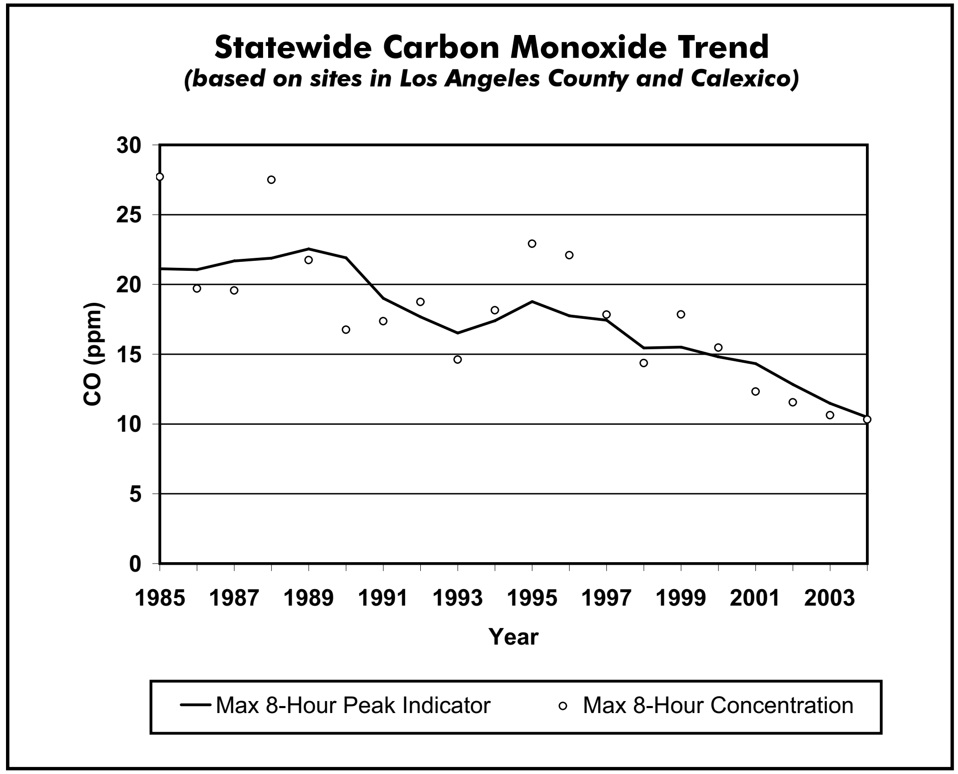

Figure 3-11

Statewide Air Quality - Lead

The decrease in lead emissions and ambient lead concentrations over the past 20 years is California's most dramatic success story. The rapid decrease in lead concentrations can be attributed primarily to phasing out the lead in gasoline. This phase-out began during the 1970s, and subsequent ARB regulations have virtually eliminated all lead from the gasoline now sold in California. All areas of the State are currently designated as attainment for the State lead standard (the U.S. EPA does not designate areas for the national lead standard). Although the ambient lead standards are no longer violated, lead emissions from stationary sources still pose "hot spot" problems in some areas. As a result, the ARB identified lead as a toxic air contaminant in 1997.

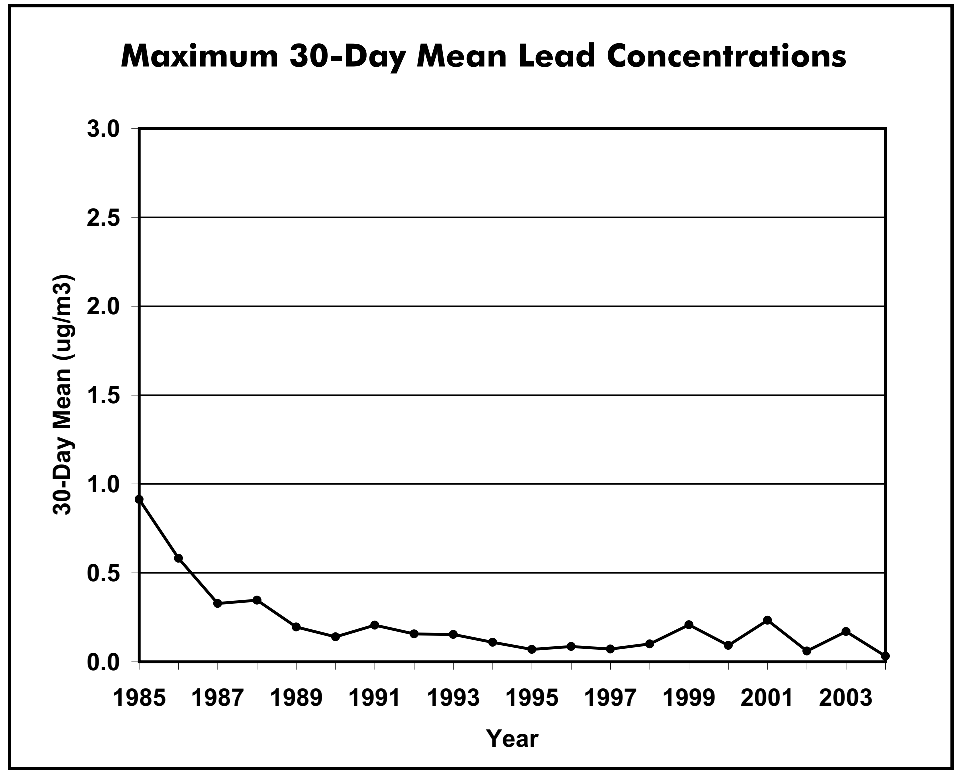

Figure 3-12

Sulfur Dioxide

Emission Trends and Forecasts - Oxides of Sulfur

Oxides of Sulfur (SO_x) is a group of compounds of sulfur and oxygen. A major constituent of SO_x is sulfur dioxide (SO_2). Emissions of SO_x declined tremendously in California between 1975 and 2005. Emissions in 2005 are about 77 percent less than emissions in 1975. Sulfur dioxide emissions from stationary sources decreased between 1975 and 2005 due to improved industrial source controls and switching from fuel oil to natural gas for electric generation and industrial boilers. The SO_x emissions from land-based on- and off-road gasoline and diesel-fueled engines and vehicles have also decreased due to lower sulfur content in the fuel; and recent regulations adopted by the ARB will reduce the sulfur content in fuel used by commercial harbor craft such as tug boats and fishing vessels beginning in 2006. However, as shown in the table below, the SO_x emissions from the "other mobile" categories are expected to increase in the future. This is due to the significant growth in shipping activities predicted for California and the high-sulfur fuels that ocean-going ships typically use. The ARB recently adopted a regulation for fuels used in ship auxiliary engines that will help offset this trend. This rule is expected to reduce SO_x emission by 22 tons per day in 2007. In addition, ARB is investigating other options for reversing this trend.

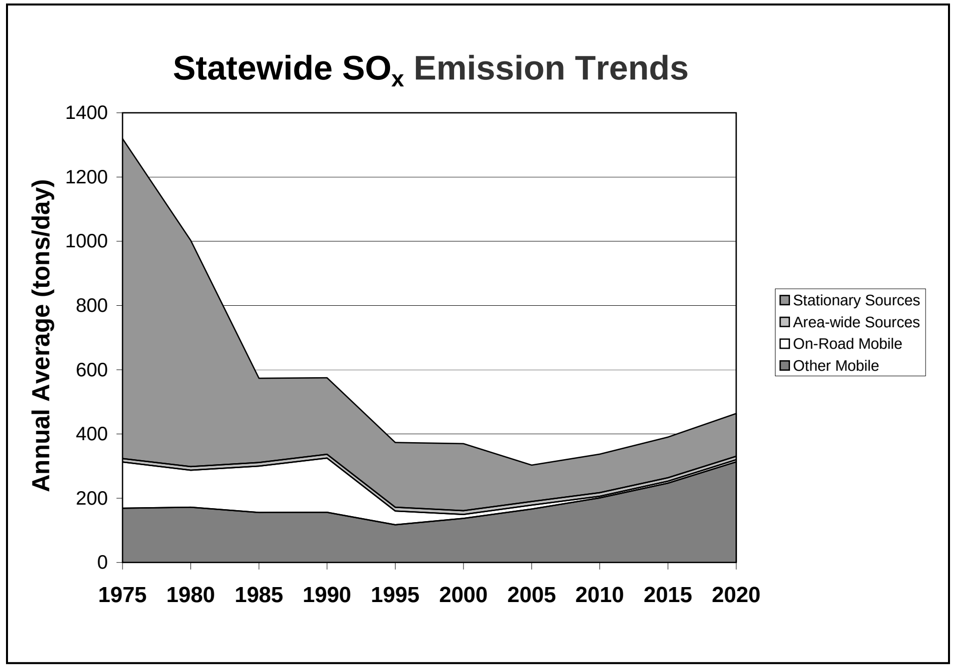

Figure 3-13

SO_x Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***1319***	***1003***	***573***	***520***	***312***	***304***	***301***	***336***	***390***	***463***
Stationary Sources	996	704	262	183	141	143	112	119	126	132
Area-wide Sources	11	11	11	12	11	11	11	11	11	11
On-Road Mobile	144	115	144	169	43	13	12	5	6	6
Gasoline Vehicles	108	52	55	60	36	5	4	4	5	5
Diesel Vehicles	35	63	89	109	7	7	9	1	1	1
Other Mobile	169	172	156	156	117	137	166	201	247	314
Gasoline Fuel	7	8	9	1	1	1	1	2	2	2
Diesel Fuel	71	82	68	67	16	18	20	21	23	25
Other Fuel	91	83	79	88	100	118	145	179	223	287

Table 3-9

Nitrogen Dioxide

Emission Trends and Forecasts - Oxides of Nitrogen

Nitrogen dioxide (NO_2) is a colorless, tasteless gas that can cause lung damage, chronic lung disease, and respiratory infections. Nitrogen dioxide is a component of oxides of nitrogen (NO_x), and its presence in the atmosphere can be correlated with emissions of NO_x. Statewide emissions of NO_x decreased by 36 percent between 1980 and 2005 and are projected to decrease by almost 32 percent from 2005 to 2020 as a result of more stringent emissions standards for stationary source combustion and motor vehicles, and cleaner burning fuels. The introduction of lower emitting vehicles will continue to further reduce NO_x emissions.

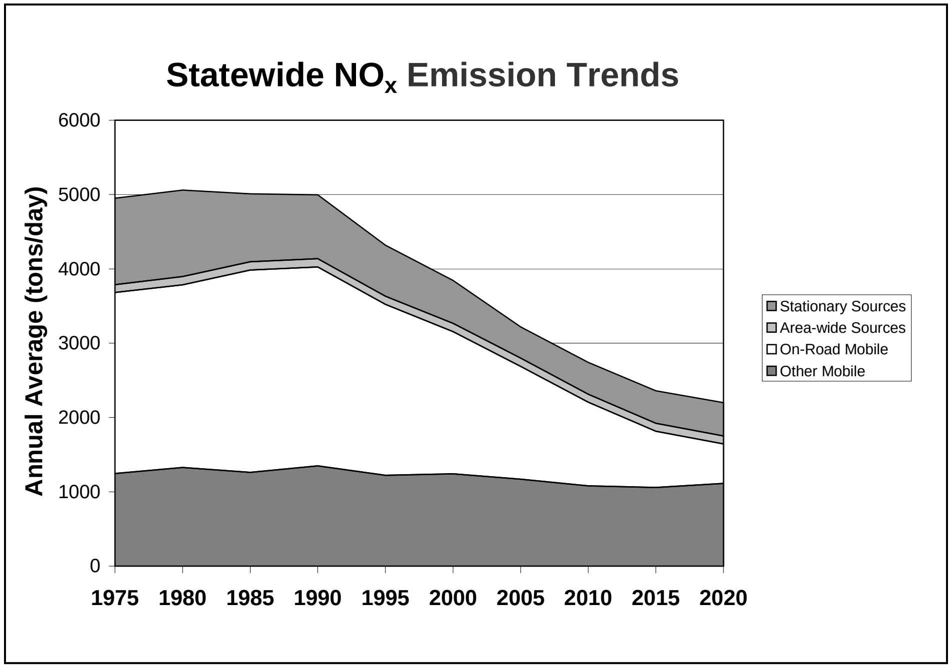

Figure 3-14

NO_x Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***4949***	***5060***	***5011***	***4997***	***4319***	***3844***	***3220***	***2741***	***2359***	***2199***
Stationary Sources	1162	1164	915	861	686	577	420	427	437	447
Area-wide Sources	106	111	113	112	110	110	112	108	107	108
On-Road Mobile	2435	2459	2721	2675	2301	1915	1518	1127	757	532
Gasoline Vehicles	2149	1975	1936	1789	1535	1113	757	536	371	266
Diesel Vehicles	286	484	784	885	766	802	761	590	386	266
Other Mobile	1247	1326	1262	1350	1222	1241	1169	1080	1057	1112
Gasoline Fuel	42	47	52	61	60	67	74	67	62	60
Diesel Fuel	980	1066	1003	1052	901	877	754	617	524	474
Other Fuel	224	213	207	237	261	298	341	395	472	578

Table 3-10

Statewide Air Quality - Nitrogen Dioxide

Oxides of nitrogen (NO_x) emissions are a by-product of combustion from both mobile and stationary sources, and they contribute to ambient nitrogen dioxide (NO_2) concentrations. Since 1985, maximum NO_2 concentrations have decreased over 57 percent, due primarily to the implementation of tighter controls on both mobile and stationary sources. Although many of these controls were implemented to reduce ozone, they also benefited NO_2. All areas of California are currently designated as attainment for the State nitrogen dioxide standard and unclassified/attainment for the national nitrogen dioxide standard. Projections show NO_x emissions will continue to decline, thereby assuring continued attainment.

ARB is currently reviewing the State standard to determine, based on the most recent health studies, if it is sufficient to protect public health.

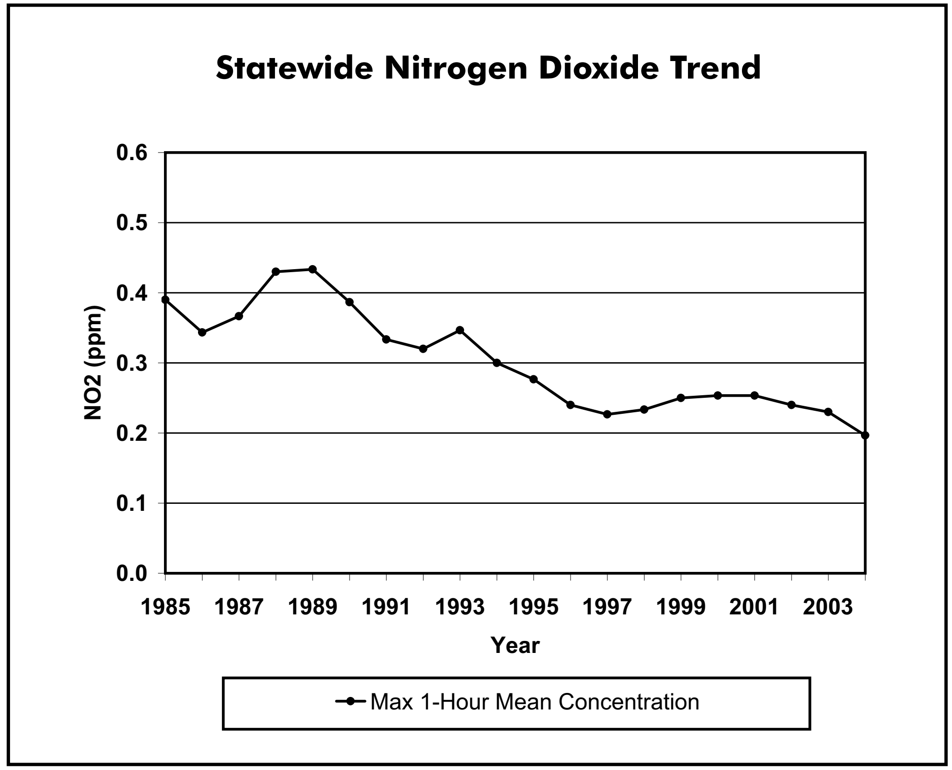

Figure 3-15

(This page intentionally left blank)